Brookhaven National Laboratory

REMEDIAL INVESTIGATION REPORT

Operable Unit III

3/1/99

What is the OU III Remedial Investigation Report?

The OU III Remedial Investigation Report describes what contaminants have been identified in Operable Unit III (OU III) and where they are located. The report also contains a Risk Assessment which examines the human health and ecological risks associated with these contaminants.

The OU III Remedial Investigation Report focuses on several areas, or plumes, of groundwater contamination at Brookhaven National Laboratory (BNL). Soils, sediment and surface water were also examined.

What are the findings of the investigation?

The main focus of Operable Unit III is groundwater contamination. The primary groundwater contaminants are solvents (volatile organic compounds, or VOCs), strontium-90 and tritium. The most common VOC contaminants are carbon tetrachloride, tetrachloroethene (also called perchloroethene, or PCE) and trichloroethane (TCA). Other VOC contaminants were also found in lesser amounts.

Soil contamination on site from underground storage tanks at Building 830 is being addressed by a removal action. Other soil samples have shown heavy metals, but at levels that are considered low.

Operable Unit III Facts

Plume Contaminants	Where are the plumes?	What has already been done?	Are there potential health risks above acceptable levels *if nothing is done*? On-site:	Off-site:
VOCs (carbon tetrachloride, TCA, PCE, etc.)	on site and off site	1 - public water hookups* 2 - two treatment systems at southern boundary (operating since 1996 & 1997) 3 - off-site treatment system (construction begun Nov. 1998) 4 - source removals 5 - monitoring	*Currently*: No. *Future*: Yes, if residents live on site and use contaminated well water.	*Currently*: Yes, if residential wells near plume become contaminated and residents use them.* *Future*: Yes, if residential wells near plume become contaminated and residents use them.*
Strontium-90	on site only	1 - excavation of chemical holes and contaminated soil (1997) 2 - monitoring	*Currently*: No. *Future*: Yes, if residents live on site and use contaminated well water.	*Currently*: No. *Future*: No.
Tritium (HFBR plume)	on site only	1 - pump-and-recharge system at leading edge of plume (operating since 1997) 2 - emptied HFBR spent fuel pool (1997) 3 - monitoring	*Currently*: No. *Future*: Yes, if residents live on site and use contaminated well water.	*Currently*: No. *Future*: No.

* Residences immediately south of BNL have been connected to the public water supply

Where is the groundwater contamination?

Three VOC plumes have been identified that extend beyond the southern boundary of BNL. Although the groundwater contaminants are found to be deeper than most residential wells, as a precautionary measure, residents immediately south of BNL were offered public water hookups.

There are three locations on the BNL site where strontium-90 was found at levels above drinking water standards. Strontium-90 has been found at the Waste Concentration Facility, the Brookhaven Graphite Research Reactor and Pile Fan Sump, and in the Chemical Holes area.

A tritium plume was detected on site in December of 1996, through groundwater samples taken near the High Flux Beam Reactor (HFBR). The source was identified as the reactor's spent fuel pool. Tritium at levels above the drinking water standard (20,000 pCi/l) extends approximately 2,600 feet south of the reactor, and is about one mile north of BNL's southern boundary.

What has already been done?

To prevent higher levels of solvents from moving off site, two treatment systems have been constructed. In 1996 and 1997, eight pumping wells were installed at the southern boundary of BNL to remove and treat water contaminated with VOCs. In November 1998, construction began on seven additional treatment wells in an industrial park located south of BNL. This system will also remove solvents from the groundwater.

The tritium plume source has been addressed by emptying the spent fuel pool and installing a system on site south of the leading edge of the plume. In this system, the tritiated water is pumped to the center of the site and released into a basin to re-enter the aquifer. This pump-and-recharge system dilutes the tritium and increases the distance traveled by the water. The resulting increase in the travel time allows natural decay to reduce the level of tritium.

One source of strontium-90 contamination has been addressed by the excavation of the Chemical Holes area and the removal of contaminated soils. Materials which were removed will be sent to a licensed waste management facility for disposal.

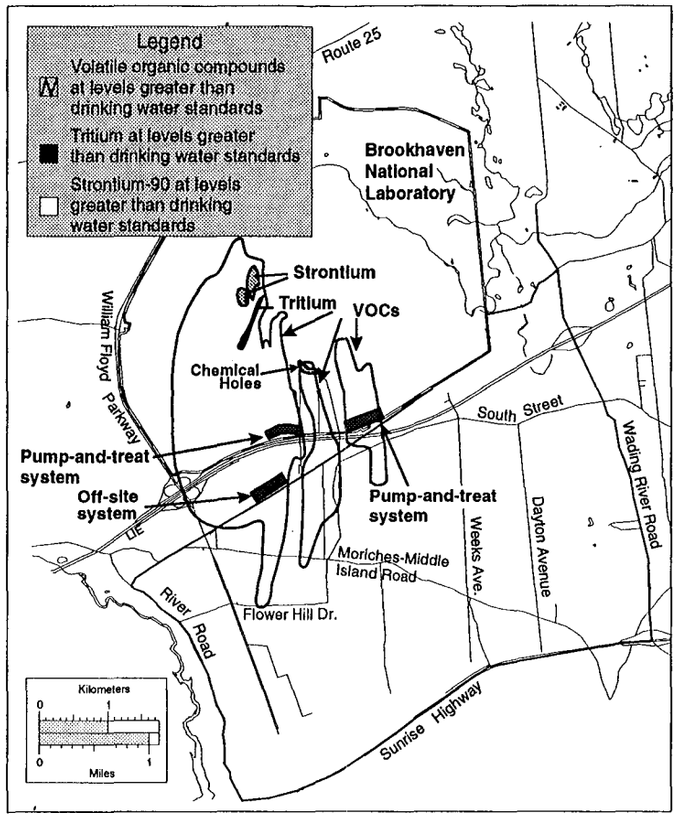
What are the risks?

Risk assessments evaluate current and future risks from the contamination, **assuming that no cleanup takes place**. Human health risks and ecological risks were evaluated in this report. Ecological risks were found to be minimal for the OU III contaminants.

Human health risks were evaluated for both current and future land-use scenarios. Various exposure pathways were considered.

For current land uses, the on-site chemical health risk is minimal. However, the presence of TCA and carbon tetrachloride in the off-site groundwater could potentially pose a health risk to off-site residents if their wells tap the contaminated water and that is their sole water source.

Assuming exposure to the highest detected levels of chemicals, the presence of solvents in the on-site



This figure shows the locations of the Operable Unit III groundwater contaminants, and VOC treatment systems. The Chemical Holes are a source of both VOCs and strontium-90.

groundwater poses potential health risks to future on-site residents if they use a contaminated well as their sole water supply. For the radiological risk assessment, computer modeling was used to estimate radiation doses and health risks. It was found that if no remedial actions are taken the presence of tritium and strontium-90 in the groundwater could pose a potential carcinogenic risk to a future on-site resident who uses contaminated well water.

What is the next step?

The Feasibility Study has evaluated cleanup alternatives for groundwater contamination. The Proposed Plan has been prepared and proposes cleanup alternatives. Information sessions and a public meeting will be held to discuss the proposed cleanup options. There will be a public comment period from March 1 to March 31, 1999 for the Proposed Plan. After all comments have been reviewed and considered, a final remediation decision will be made jointly by the New York State Department of Environmental Conservation, the U.S. Environmental Protection Agency, and the DOE. The decision will be documented in the Record of Decision for Operable Unit III.

Contact Information

For more information, contact:

John Carter
U.S. Department of Energy
(516) 344-5195

Eloise Gmur
BNL
(516) 344-6336

Mary Logan
U.S. Environmental Protection Agency
(212) 637-4321

Jim Lister
N.Y. State Department of Environmental Conservation
(518) 457-3976

Copies of the Feasibility Study and the Proposed Plan are available for review at:

Longwood Public Library
(516) 924-6400

BNL Research Library
(516) 344-3483

Mastics-Moriches-Shirley Library
(516) 399-1511

U.S. EPA, Region II Library
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Brookhaven National Laboratory

FEASIBILITY STUDY AND PROPOSED PLAN

3/1/99

Operable Unit III

The *Operable Unit III Feasibility Study* describes and evaluates potential cleanup alternatives. The *Operable Unit III Proposed Plan* details the U.S. Department of Energy's (DOE) proposed cleanup options for on-site and off-site groundwater contamination.

What contaminants were found?

The primary contaminants at the Brookhaven National Laboratory (BNL) site (on-site) in Operable Unit III are solvents (volatile organic compounds, or VOCs), strontium-90 and tritium. The most common off-site (beyond BNL site boundary) VOC contaminants are carbon tetrachloride, tetrachloroethene and trichloroethane. Other VOC contaminants were also found on-site and off-site in lesser amounts.

Where is the groundwater contamination?

Several plumes, or areas, of groundwater contamination have been identified. The plumes of groundwater that contain solvents extend from the middle of the BNL site southward. The leading edge of the longest plume is at Flower Hill Drive (see map on back). As a precautionary measure, public water hookups have been provided to residents south of the Lab.

A tritium plume whose source was the spent fuel pool of the High Flux Beam Reactor (HFBR) has been identified. It is confined to BNL property. Levels of tritium above the drinking water standard are found near the center of BNL and extend to a point about one mile north of the southern boundary of the Lab.

There are concentrated areas of strontium-90 contamination in the groundwater at these on-site locations: the Chemical Holes Area, the Brookhaven Graphite Research Reactor (BGRR) and Pile Fan Sump, and the Waste Concentration Facility (WCF).

Contaminant	Preferred Alternative	Major Components of Alternative	Time for Cleanup
VOCs	**V10b** - On-site In-well Air Stripping/Off-site In-well Air Stripping at LIPA right-of-way, several unpopulated areas, and at Brookhaven Airport	- continued operation of existing treatment systems - on-site source removal - additional on-site and off-site in-well treatment systems - natural attenuation - monitoring	30 years (for Upper Glacial aquifer)
Tritium	**T4** - Contingency Based Remediation	- existing system placed on standby - additional pumping if tritium levels vary substantially from expected levels - natural attenuation - monitoring	20 - 25 years
Strontium-90	**S5a** - Groundwater Extraction/Ion Exchange/ On-site Discharge/ Natural Attenuation	- installation of groundwater extraction/ion exchange treatment systems at Chemical Holes, WCF, and Pile Fan Sump - natural attenuation - monitoring	25 - 30 years

The preferred cleanup alternatives and their major components are given in the chart above. Cleanup times are times to reach Remedial Action Objectives (RAOs). Remedial Action Objectives are time-based goals for the completion of groundwater cleanup. Final contaminant levels will be below drinking water standards.

What are the cleanup alternatives?

For the VOCs, seven cleanup alternatives were examined in the Feasibility Study. These alternatives included one or more of the following elements: No action (which is required for comparison with other options), construction of on- and off-site groundwater treatment systems, continuing operation of existing groundwater treatment systems, and carrying out an on-site source removal. The alternatives varied in the elements used, the number and location of treatment systems, and the amount of time it would take to reach cleanup objectives.

Eight alternatives were examined for remediating the tritium plume. These alternatives included one or more of the following elements: No action, natural attenuation, operation of the existing pumping system, placing the existing system in a "standby" mode, installing an extraction system immediately south of the HFBR, and installing additional extraction wells at the leading edge of the plume.

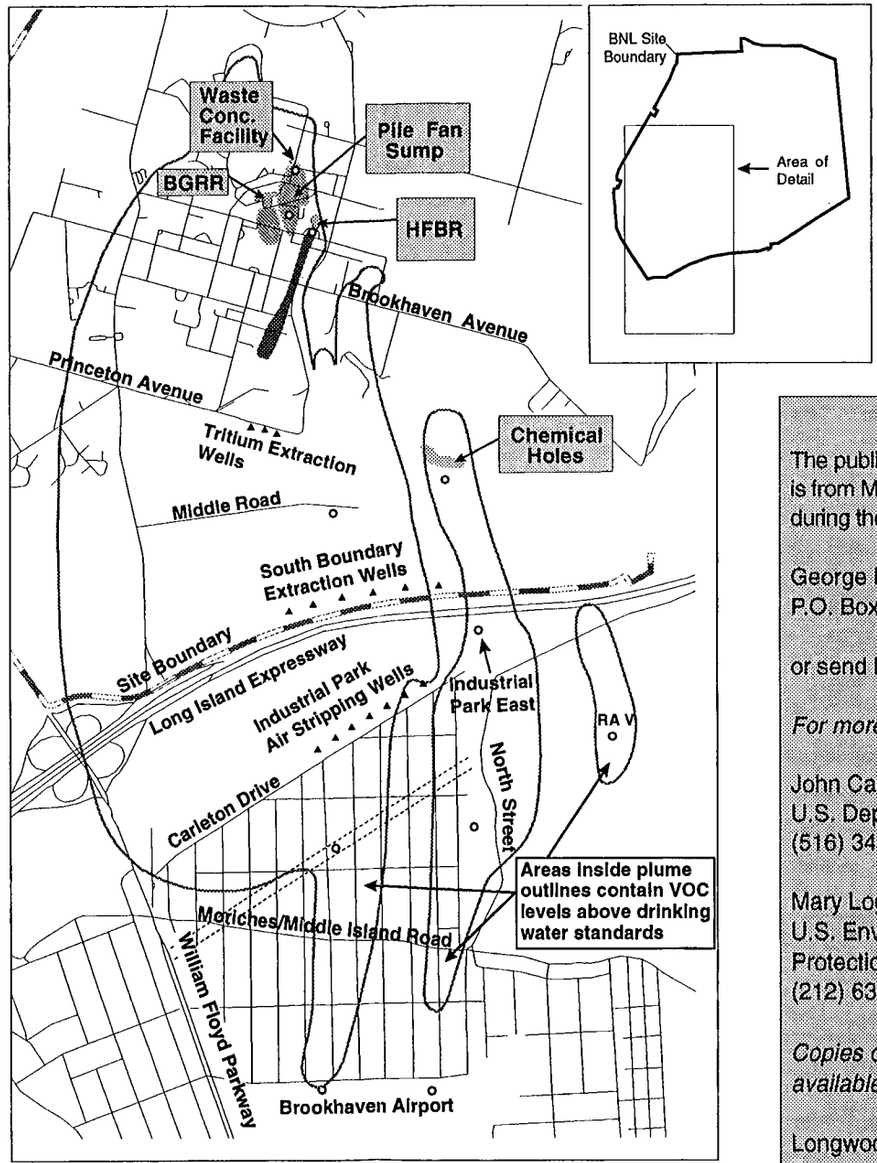
Five alternatives for strontium-90 remediation were examined. These alternatives included one or more of the following elements: No action, natural attenuation, groundwater extraction and treatment, injection of chemicals to precipitate out the strontium, and use of a permeable wall to capture the strontium.

What are the DOE's proposed cleanup methods?

For the VOC plumes, the DOE's proposed alternative is **V10b**. This will involve the use of on-site and off-site groundwater treatment systems at several locations. Treatment systems would be placed on site, and off site in the Long Island Power Authority right-of-way, in unpopulated areas of North Street and east of North Street, at the Brookhaven Airport, and in the eastern portion of the industrial park located south of BNL. This alternative also includes the continued operation of the existing on- and off-site treatment systems, as well as a source removal action. Natural attenuation and monitoring are included in this alternative.

For the tritium plume, the DOE's preferred alternative is **T4** - contingency based remediation. In this alternative, the current pump-and-recharge system will be placed on standby. The tritium levels will decline through a combination of radioactive decay, dilution, and dispersion. Monitoring will continue. The need to restart the existing pump-and-recharge system, and/or to start operating a new system immediately south of the HFBR, will be evaluated if tritium levels diverge substantially from those expected.

For the strontium-90, the DOE's preferred alternative is **S5a**. This will involve the installation of groundwater extraction/ion exchange treatment systems. These systems will extract the groundwater, treat it by ion exchange to remove the strontium-90, and discharge the clean water to on-site recharge basins.



This figure shows the locations of groundwater contaminants at levels above drinking water standards as well as the locations of the tritium and strontium-90 sources. It also indicates proposed locations for treatment systems.

Contact Information

The public comment period for the Operable Unit III Proposed Plan is from March 1 to March 31, 1999. Submit comments in writing during the comment period to:

George Malosh, U.S. Department of Energy
P.O. Box 5000, Upton, N.Y. 11973-5000

or send by e-mail to: OU3comments@bnl.gov

For more information, contact:

John Carter
U.S. Department of Energy
(516) 344-5195

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